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DECLARATION

The undersigned, Jan McLin Clayberg, having an office at 5316 Little Falls Road, Arlington, VA 22207-1522, hereby states that she is well acquainted with both the English and German languages and that the attached is a true translation to the best of her knowledge and ability of international patent application PCT/DE 03/02337 of Lamprecht, J. et al., entitled "BEARING ARRANGEMENT FOR VIBRATINGLY SUPPORTING A GRINDING DISK ON A GRINDING APPARATUS".

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.


Jan McLin Clayberg

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1 BEARING ARRANGEMENT FOR VIBRATINGLY SUPPORTING A GRINDING
2 DISK ON A GRINDING APPARATUS

3
4 Prior Art

5
6 The invention is based on a bearing arrangement for
7 vibratingly supporting a grinding disk on a grinding
8 apparatus, in particular a 1/4-blade vibrating grinder, as
9 generically defined by the preamble to claim 1.

10
11 In conventional vibrating grinders, the grinding disk
12 is driven to execute lateral vibrating motions by an
13 eccentric; the grinding disk is connected to the grinding
14 apparatus by elastic vibration legs.

15
16 The vibration legs prevent the rotary motion of the
17 eccentric from being transmitted to the grinding disk, on the
18 one hand, and thus form a means of securing the grinding disk
19 against relative rotation.

20
21 On the other hand, the vibration legs absorb the
22 contact pressure acting on the grinding disk and carry it
23 onward to the grinding apparatus.

24
25 Finally, upon their torsion-caused deformation, the
26 vibration legs are intended to dissipate as little
27 vibrational energy, in the form of energy of deformation, as
28 possible so as to economize on electrical energy for driving
29 purposes; this is especially important for grinding
30 apparatuses operated by rechargeable batteries, because of
31 the limited capacity of such batteries.

32
33 Conventionally, the vibration legs are joined together
34 by a plastic bridge and form a unitary component, so that all

1 the vibration legs are mounted together with the plastic
2 bridge.

3
4 In grinding apparatuses with integrated removal of dust
5 by vacuum, however, the installation space for the vibration
6 legs is very limited, so that such plastic bridges with a
7 plurality of vibration legs cannot be installed.

8 9 Advantages of the Invention

10
11 By comparison, the invention provides a bearing
12 arrangement for vibratngly supporting a grinding disk on a
13 grinding apparatus in which the vibration legs are each
14 disposed individually or in groups of a plurality of
15 vibration legs in a plurality of separate modules.

16
17 Dividing up the individual vibration legs among a
18 plurality of modules offers the advantage that for mounting
19 in a grinding apparatus, less mounting space is needed, since
20 the modules can each be installed individually.

21
22 Preferably, each module has three vibration legs, but
23 the individual vibration legs may also be divided up among
24 the individual modules in some other way. For instance, each
25 module may have one, two, or four vibration legs.

26
27 In the bearing arrangement of the invention, the
28 elastic connection of the grinding disk to the grinding
29 apparatus need not necessarily be done by means of vibration
30 legs, however, whose length is substantially greater than
31 their thickness. Instead, it is also possible to use
32 vibration bodies of some other design, as long as the
33 vibration bodies form an elastic connection between the
34 grinding disk and the grinding apparatus.

1
2 Moreover, the bearing arrangement of the invention can
3 be used not only in a grinding apparatus but also in a
4 polishing apparatus, in which a polishing disk is driven to
5 execute lateral vibrational motions by an eccentric. The
6 bearing arrangement of the invention then connects the
7 polishing disk to the polishing apparatus in a manner capable
8 of vibration.

9
10 In a preferred embodiment of the invention, the
11 individual modules have a bayonet mount for mounting them on
12 the grinding apparatus. Securing the individual modules is
13 thus preferably done by slipping the individual modules on
14 and then displacing them or twisting them, so that mounting
15 can be done without a tool.

16
17 Preferably, the individual modules each have one groove
18 and/or one tongue, so that adjacent modules, in the mounted
19 state, form a tongue-and-groove connection. This offers the
20 advantage that the strength of the bearing arrangement of the
21 invention, despite being divided up among a plurality of
22 modules, is similar in quality to conventional bearing
23 arrangements with a plastic bridge for connecting the
24 individual vibration legs.

25
26 The individual modules preferably have a mounting body
27 for fastening to the grinding apparatus and a guide body for
28 guiding the grinding disk; the mounting body is joined to the
29 guide body by at least one of the vibration bodies. The guide
30 body with the grinding disk can thus execute vibrational
31 motions relative to the mounting body, motions that are
32 generated for instance by an eccentric.

33
34 Preferably, for being screwed to the grinding disk, the

1 guide body has a screw receptacle, which may for instance
2 comprise a simple blind bore that can be engaged on the
3 inside by a fastening screw. Thus the fastening of the
4 grinding disk is done by means of screws, which are screwed
5 into the screw receptacle through the grinding disk from the
6 workpiece side of the grinding disk.

7
8 To make mounting the grinding disk on a grinding
9 apparatus with the bearing arrangement of the invention
10 easier, the guide body, on its side toward the grinding disk,
11 preferably has a protrusion which positively engages a
12 suitably adapted fastening receptacle in the grinding disk.

13
14 Preferably, the protrusion on the guide body is non-
15 round, in order to form a means of securing against relative
16 rotation. When the grinding disk is screwed tightly to the
17 bearing arrangement of the invention, the torque introduced
18 into the guide body of the bearing arrangement by the
19 fastening screw is then diverted into the grinding disk, via
20 the positive-engagement connection, fixed against relative
21 rotation, between the protrusion on the guide body and the
22 fastening receptacle of the grinding disk.

23
24 In a preferred embodiment, the mounting body of the
25 bearing arrangement of the invention is platelike and on one
26 side edge has at least one recess for a suitably adapted
27 tongue on the grinding apparatus. Upon installation, the
28 individual modules are accordingly slipped onto the grinding
29 apparatus in such a way that the tongue on the grinding
30 apparatus engages the associated recess on the side edge of
31 the module. Next, the modules are displaced, so that the
32 tongue on the grinding apparatus is no longer located above
33 the recess, but instead grasps the side edge of the mounting
34 body and fixes it as a result. For disassembly, the module

1 must then be displaced again such that the tongue is located
2 above the recess in the side edge of the mounting body,
3 whereupon the module can be simply taken off.

4
5 Moreover, in one embodiment of the invention, the
6 mounting body has at least one protrusion, which in the
7 mounted state forms a connection by frictional engagement
8 with a suitably adapted receptacle on the grinding apparatus.
9 Preferably, this protrusion is immediately adjacent the
10 recess in the side edge of the mounting body, so that upon
11 displacement of the mounting body, a frictional or clamping
12 action is created, whereby the module is fixed.

13
14 Furthermore, the mounting body, on the side toward the
15 grinding apparatus and/or on the side remote from the
16 grinding apparatus, has a tongue, which in the mounted state
17 forms a tongue-and-groove connection with a suitably adapted
18 groove on the grinding apparatus.

19
20 It should also be noted that the invention is not
21 limited to the bearing arrangement described above but
22 instead also encompasses a complete grinding or polishing
23 apparatus with such a bearing arrangement.

24
25 Drawing

26
27 Further advantages will become apparent from the
28 following description of the drawings. In the drawings, one
29 exemplary embodiment of the invention is shown. The drawing,
30 description and claims include numerous characteristics in
31 combination. One skilled in the art will expediently consider
32 the characteristics individually as well and put them
33 together to make useful further combinations.

1 Shown are:

2
3 Fig. 1, a sectional view through a conventional
4 vibrating grinder;

5
6 Figs. 2a-2c, perspective views of a module of a bearing
7 arrangement of the invention; and

8
9 Figs. 3a-3b, the module, shown in Figs. 2a through 2c,
10 in various positions during the installation.

11
12 Description of the Exemplary Embodiment

13
14 The cross-sectional view in Fig. 1 shows a vibrating
15 grinder 10, which is of conventional construction and will be
16 described briefly below, in order then to address the special
17 features of the invention.

18
19 The vibrating grinder 10 has an electric motor, which
20 drives a power takeoff shaft 14; the power takeoff shaft 14
21 is additionally rotatably supported in a ball bearing 16.

22
23 The power takeoff shaft 14 has a free end onto which an
24 eccentric sleeve 18 is press-fitted, so that the eccentric
25 sleeve 18 is secured on the power takeoff shaft 14 in a
26 manner fixed against relative rotation and fixed in the axial
27 direction. Instead of the press fit employed here, however,
28 the fastening of the eccentric sleeve 18 to the power takeoff
29 shaft 14 may be done in some other way, such as by means of a
30 screw connection.

31
32 The eccentric sleeve 18 accordingly rotates with the
33 power takeoff shaft 14 and is therefore balanced relative to
34 the power takeoff shaft 14, to avoid vibration in operation.

1
2 On its end toward the workpiece, the eccentric sleeve
3 18 furthermore has a cup-shaped, cylindrical receptacle for a
4 ball bearing 20 with an inner ring and an outer ring; the
5 receptacle for the ball bearing 20 is disposed eccentrically
6 relative to the power takeoff shaft 14. The outer ring of the
7 ball bearing 20 is pressed into the receptacle, while a
8 sleevelike receptacle part 22 is press-fitted into the inner
9 ring of the ball bearing 20.

10
11 The sleevelike receptacle part 22 serves to secure a
12 grinding disk 24, and for that purpose, on its end toward the
13 tool, it has a female thread 26, as can be seen particularly
14 in Fig. 2. For securing the grinding disk 24 to the grinding
15 apparatus 10, the grinding disk has a mounting bore 28 in its
16 middle region, through which bore a central fastening screw
17 30 can be screwed into the female thread 26 of the receptacle
18 part 22. Securing the grinding disk 24 to the grinding
19 apparatus 10 by a screw connection thus makes simple
20 replacement of the grinding disk 24 possible, so that once
21 suitable grinding disks 24 have been selected, either plane
22 grinding or contour grinding can be selectively done with the
23 same grinding apparatus 10.

24
25 Moreover, the grinding apparatus 10 has a plurality of
26 elastic vibration legs 32 of polyoxymethylene (POM), which
27 guide a guide element 34 in a manner that is secure against
28 relative rotation but is laterally resilient. However, the
29 vibration legs 32 may comprise other elastic, tough
30 materials, which as much as possible exhibit no material
31 fatigue whatever even after long periods of operation and
32 frequent deformations; examples that can be named are
33 polyamide (PA) and polypropylene (PP).

1 The guide element 34 engages the inside of an
2 encompassing collar 36, formed integrally onto the top of the
3 grinding disk 24, so that the freedom of motion of the
4 grinding disk 24 is limited to plane-parallel motions. The
5 encompassing collar 36 of the grinding disk 24 is accordingly
6 non-round and is approximately triangular, as a result of
7 which the grinding disk 24 is secured against twisting.

8
9 Accordingly, because of the eccentric bearing of the
10 receptacle part 22 in the eccentric sleeve 18, a rotation of
11 the power takeoff shaft 14 leads to plane-parallel grinding
12 motions of the grinding disk 24.

13
14 The grinding apparatus 10 furthermore has a housing 38,
15 which on its underside is flush with the top of the grinding
16 disk 24 by means of a sealing lip 40.

17
18 Figs. 2a through 2c and 3a and 3b, conversely, show a
19 module of a four-part bearing arrangement that can be
20 employed in a vibrating grinder similar to the vibrating
21 grinder 10, instead of the guide element 34 with the
22 vibration legs 32.

23
24 The module 42 has a mounting plate 44 and a guide plate
25 46, which are joined together by three elastic vibration legs
26 48; the mounting plate 44, guide plate 46, and vibration legs
27 48 are of plastic. Because of their elasticity, the three
28 vibration legs 48 enable a lateral vibrational motion of the
29 grinding disk 24 that is driven by the eccentric sleeve 18.

30
31 In the installed state, the guide plate 46 is joined to
32 the grinding disk 24. To that end, the guide plate 46 has a
33 screw receptacle 50, which is engaged in the installed state
34 by a fastening screw, which by means of a screw connection

1 connects the grinding disk 24 to the guide plate 46. The
2 guide plate 46 furthermore, on its side toward the grinding
3 disk 24, has a protrusion 52, which in the installed state
4 engages a receptacle in the grinding disk 24 in order to
5 establish a positive-engagement connection between the
6 grinding disk 24 and the guide plate 46. The protrusion 52
7 here is non-round and has two flattened sides, thus forming a
8 means of securing against relative rotation. This is
9 advantageous, since in this way, when the fastening screw is
10 tightened in the screw receptacle 50, the torque introduced
11 into the guide plate 46 is diverted into the grinding disk 24
12 via the positive-engagement connection, secure against
13 relative rotation, between the protrusion 52 and the
14 associated receptacle in the grinding disk 24.

15
16 In the installed state, conversely, the mounting plate
17 44 of the module 42 is connected to the housing 38 of the
18 grinding apparatus 10, as can be seen from Figs. 3a and 3b.
19 The connection between the mounting plate 44 and the housing
20 38 of the grinding apparatus 10 is effected by means of a
21 bayonet mount, so that simple installation and disassembly of
22 the module 42 without a tool is possible.

23
24 To this end, the mounting plate 44 has two recesses
25 54.1, 54.2 on one side edge, and these are engaged, in the
26 mounting position shown in Fig. 3a, by two tongues 56.1,
27 56.2, so that the module 42 can be introduced into the
28 housing 38 on the side toward the workpiece. In the process,
29 the tongues 56.1, 56.2 slide through the associated recesses
30 54.1, 54.2 on the mounting plate 44.

31
32 Next, the module 42 is then thrust out of the mounting
33 position shown in Fig. 3a into the final position shown in
34 Fig. 3b; in the final position of the module 42, the tongues

1 56.1, 56.2 rest on the mounting plate 44 next to the recesses
2 54.1, 54.2 and thereby clamp the mounting plate 44 firmly.

3
4 To improve the clamping action between the tongues
5 56.1, 56.2 and the mounting plate 44, a protrusion 58, which
6 in the final position of the module 42 presses against the
7 tongue 54.1, is integrally formed onto the side of the
8 mounting plate 44 toward the tongue 56.1, at the edge of the
9 recess 54.1.

10
11 Moreover, two tongues 60, 62 are integrally formed onto
12 the mounting plate 44 and guide the mounting plate 44 in the
13 installed state; the tongue 60 engages a suitably adapted
14 groove in the housing 38 of the grinding apparatus 10.

15
16 The mounting plate 44 of the module 42 also has a
17 wedge-shaped groove 64, which is engaged in the mounted state
18 by a suitably adapted tongue of an adjacent module, so that
19 the individual modules of the bearing arrangement of the
20 invention are connected mechanically to one another and can
21 nevertheless be installed individually and therefore in a way
22 that requires little space.

23
24 Overall, the bearing arrangement of the invention
25 comprises four modules 42 that are mirror images of one
26 another, and which each have either the groove 64 or a
27 suitably adapted tongue.

28
29 The invention is not limited to the preferred exemplary
30 embodiment described above. On the contrary, many variations
31 and modifications may be made that also make use of the
32 concept of the invention and are therefore within its patent
33 scope.

1		
2	List of Reference Numerals	
3		
4	10	Grinding apparatus
5	14	Power takeoff shaft
6	16	Ball bearing
7	18	Eccentric element
8	20	Ball bearing
9	22	Receptacle part
10	24	Grinding disk
11	26	Female thread
12	28	Mounting bore
13	30	Fastening screw
14	32	Vibration leg
15	34	Guide element
16	36	Collar
17	38	Housing
18	40	Sealing lip
19	42	Module of the bearing arrangement
20	44	Mounting plate
21	46	Guide plate
22	48	Vibration leg
23	50	Screw receptacle
24	52	Protrusion
25	54.1, 54.2	Recess
26	56.1, 56.2	Tongue
27	58	Protrusion
28	60	Tongue
29	62	Tongue
30	64	Groove